

**Economic Assessment
of the
Fisheries and Marine Resources
of
Taunton Bay**

Prepared for
The Taunton Bay Study:
A Pilot Project in Collaborative Bay Management

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Economic Analysis of the Fisheries and Resources of Taunton Bay

Acknowledgments

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information regarding harvesting practices.*

EXECUTIVE SUMMARY

Compiled as a deliverable for the Taunton Bay Study, this report provides an estimate of harvesting activities and revenues for marine resources in Taunton Bay. The report reviews harvest practices, prices, and relative values for alewives, elvers, worms, lobsters, crabs, mussels, clams, kelp, urchins, scallops, oyster aquaculture, and land-based aquaculture. Three sources of data were reviewed: 1) MDMR Licensing Data, 2) MDMR Landings Data, and 3) personal interviews with harvesters, dealers, and other specialists. Since there is little MDMR bay-level landings data available, the primary source of revenue information for the report is from personal interviews.

MDMR Licensing Data indicate that 8.5% of year-round households in Hancock, Sullivan, and Franklin depend on marine resources as a source of income and that 20% of those license-holders harvest multiple species throughout the year. The data also indicate that the four most commonly harvested species in the area are lobsters/crabs (36%), marine worms (26%), clams (12%), and elvers (7%), but the data do not indicate where this harvesting is taking place. Lastly, the data indicate that area harvesters represented 12% of county licenses between 1999 and 2004, and that there was a 20% decrease in the number of area license-holders during that time.

Using information gleaned from interviews, as well as MDMR Landings and Licensing Data, the total estimated revenue for all fisheries/resources obtained from TB during 2003-2004 ranges from \$4,170,258 to \$10,263,390. The significant range of revenue variability is most likely due to differences in effort, market, weather, and willingness to report accurate information. The four species with the greatest potential individual gross revenue currently are worm aquaculture, elvers, sea urchins, and oyster aquaculture.

Five recommendations regarding future bay-management considerations are provided:

1. This report is preliminary and provides only estimates, therefore, agencies and organizations should consider a more comprehensive review of the local marine economy.
2. Since bay-level data are currently unavailable, the state should work directly with local communities to devise a method whereby bay-level or harvester-level data can be shared without threatening the confidentiality of harvesters.
3. Harvesters and town governments are the primary local users and decision-makers; as such, state and federal agencies and local conservation organizations should intensify efforts to engage harvesters and town officials.
4. This report dealt strictly with revenues and not management issues therefore, there should be a well-planned effort to explore, document, and develop action items to address local fisheries management issues.
5. There is little data on potential biomass for TB fisheries and ecosystem; MDMR and other researchers should develop local maximum sustainable yield and optimum sustainable yield models for the bay using ecosystem-based management principles.

I. INTRODUCTION

A. Purpose and Scope of Report

In January 2005, the Friends of Taunton Bay received a grant from the Maine Land and Water Resources Council to determine how marine resource management in Maine may be improved at the local level. In order to gain a better understanding of the value of bay resources, BSA Environmental Consulting was asked to provide an “Economic Analysis of the Fisheries and Marine Resources of Taunton Bay.” This report reviews harvest practices, prices, and relative values for alewives, elvers, worms, lobsters, crabs, mussels, clams, kelp, urchins, scallops, oyster aquaculture, and land-based aquaculture. The ultimate goal of this report is to provide information regarding how many people depend on the bay as a source of income and what is the current (and/or potential) revenue that can be derived from those resources.

This report is not meant to be comprehensive. Given time and financial constraints and the challenges associated with obtaining data, the information given in the report should be considered preliminary and serve only as an estimate of actual harvesting practices and revenues.

B. Physical Description of Assessment Area

Located in eastern Hancock County, Maine, Taunton Bay (TB) drains portions of 8 towns and townships (T10SD, T9SD, Fletchers Landing Township, Eastbrook, Sullivan, Franklin, Waltham, and Hancock). The name, Taunton Bay, collectively refers to Taunton River, Hog Bay, and Egypt Bay and comprises 3,282 acres above the Hancock-Sullivan Tidal Falls. The bay drains into Sullivan Harbor and Frenchman Bay.

II. METHODS

Information for this report was obtained using the following methods. Each method is briefly described in section II A:

1. Landings data obtained from the Maine Department of Marine Resources (MDMR) Landing Office.
2. Licensing data obtained from the MDMR Licensing Office.
3. Personal interviews with harvesters and enterprises using the bay as well as natural resource economists

A. MDMR Landings Data

The use of MDMR landings data to create a bay-level economic assessment is complicated by several factors. The only landings data available from MDMR at the local level is clam data, which is reported by town and shellfish-sanitation area. Data for all other species is available only at the county or state level because under statute 6173 and MDMR Regulations Chapter 5, all data must be aggregated in such a way as the identity of the person who submitted the data cannot be determined (Table I). If there are less than 3 dealers or harvesters who submit data for a specific region, the data must be aggregated to the next level. In most cases, less than three dealers submit data for any one port of landing per year. Because of this regulation, MDMR cannot release figures by town or county with the one exception of clams (H. Bray, MDMR, Personal Communication, 2005).

Another factor affecting the use of landings (and licensing) data is the recent change in MDMR reporting and collecting methods. Because methods have changed dramatically in recent years, only recent data can be compared for historic purposes. Therefore, the focus of MDMR data analysis in this report is for years 2003-2004 for landings and 1999-2004 for licensing. In most cases, only data for 2003 and 2004 were considered.

Table I. Landings Data Availability by Species, 2003-2004.

Species	Town	Co	State
Lobster		x	
Clams	x		
Mussels		x	
Worms			x
Oysters (Aquaculture)			x
Scallop		x	
Sea Urchin		x	
Seaweed			x
Shrimp		x	
Crab		x	
Alewives			x
Elvers			x
Groundfish			x

The interpretation of landings data is further complicated by the fact that for most species, data are gathered from dealers and not harvesters, so harvest locations are unknown. Furthermore, while reporting for some species is mandatory, reporting for many other species is only voluntary (e.g., scallops, crabs, and shrimp).

Because of the lack of fisheries data at the municipality or bay level (with the exception of clams), species-specific economic information for this report is described anecdotally using responses from personal interviews with harvesters, dealers, and other specialists (see Section II C).

Lastly, it should be noted that all revenues given in this report are GROSS and reflect only the value of the landings. The revenues do NOT reflect the cost associated with each fishery (i.e., cost of fuel, boat maintenance, fees, insurance, etc); nor does it reflect the level of effort, which may vary greatly among harvesters.

B. Licensing Data

The DMR Hancock County License lists were used to determine the average individual harvester revenue from the county landings revenue data. For example, by dividing the total Hancock County crab landings revenues by the total number of Hancock County crab license holders, one can determine the average individual revenue from crab harvesting. However, this method was only used when no other source of data was available because the license list does not indicate where each harvester is harvesting and therefore, does not accurately reflect activity in Taunton Bay. For example, a harvester from Franklin may harvest anywhere on the coast including or excluding Taunton Bay. Likewise a harvester from Machias may harvest his/her home waters and also travel to Taunton Bay, however, his/her name would not appear on the local license list. In either case, there is no current system for tracking the specific bay from which harvesters operate (with the exception of clams).

Since the license lists indicate the harvesters' towns of residence, years of license, and the species harvested, they can be used to estimate the number of harvesters living in the TB area and to review trends in local harvesting activity. Again, since there is currently no method for determining where a harvester is harvesting, only licensing data from the towns of Hancock, Sullivan, and Franklin were reviewed. For this part of the report, the three towns are considered a sample of the whole TB harvesting community. As such, the information should only be considered an estimate of the total amount of harvesting activity since it does not include harvesters from other towns.

C. Personal Interviews

Personal interviews were conducted with over 20 individuals who have interests in the bay including harvesters, dealers, entrepreneurs, economists, and MDMR staff. The interviews were conducted between May and August 2005 and revenues reflect 2004

prices. Because of the nature of the species harvested, individual personality, and operational differences, no two interviews were alike. The typical questions asked of harvesters included:

- Do you harvest in Taunton Bay?
- Which species do you harvest?
- Explain the harvesting process, season, etc.
- How many pounds did you harvest in 2004?
- What was the price at that time?

Every effort has been made to maintain confidentiality and anonymity of harvesters, dealers, and other entrepreneurs, and as such, no names are used. It should be noted, however, that some harvesters were reluctant to share honest and accurate information for fear of losing their anonymity. Furthermore, one harvester chose not to share harvesting information for fear that the information would not be used appropriately.

Lastly, the reader should be aware that information from personal interviews is anecdotal and highly variable. In most cases, harvesters were uncertain of the amount they harvested or how much revenue was earned from any given species. Intentional underestimating (for disclosure purposes) and overestimating (boastfulness) is most likely commonplace. Furthermore, not all harvesters work the same number of days or with the same intensity and market values can fluctuate greatly within the same season thus, the range of potential harvest amounts and subsequent revenues varies widely.

Therefore, the information obtained from personal interviews should only be considered an approximation or estimate of actual harvesting levels and values.

III. RESULTS

A. Harvested Species in Taunton Bay

According to MDMR data and personal interviews, the following marine species are known to be currently or recently harvested from Taunton Bay:

Table 2. Marine Species Harvested from Taunton Bay

Common Name	Scientific Name
Soft shelled clams	<i>Mya arenaria</i>
Bloodworms (native & aquaculture)	<i>Glycera spp.</i>
Blue mussels	<i>Mytilus edulis</i>
Elvers (juvenile eels)	<i>Anguilla rostrata</i>
Alewives	<i>Alosa pseudoharengus</i>
Kelp	<i>Laminaria longicuris</i>
Oyster (aquaculture)	<i>Crassostrea virginica</i>
Lobsters	<i>Homarus americanus</i>
Crabs	<i>Cancer spp.</i>
Sea urchins	<i>Strongylocentrotus droebachiensis</i>
Halibut (aquaculture)	<i>Hippoglossus hippoglossus</i>
Scallops	<i>Plactopecten magellanicus</i>

B. License Data as an Indicator of Harvesting Activity

Commercial harvesters are required to obtain a license for each species harvested. Data from the MDMR harvest license lists indicate that 253 licenses were issued to 181 individuals in Hancock, Franklin, and Sullivan in 2004. Out of the 181 harvesters, 141 harvesters held one license and 40 harvesters held more than one license (generally 2-4 different species). The greatest number of licenses held by one person was 5. This suggests that approximately 20% of harvesters earn a living by harvesting multiple species throughout the year. The most common combination of licenses is among divers, who hold licenses for both sea urchins and scallops. Lobster fishermen and worm diggers have longer seasons and therefore, most of these harvesters hold only one license.

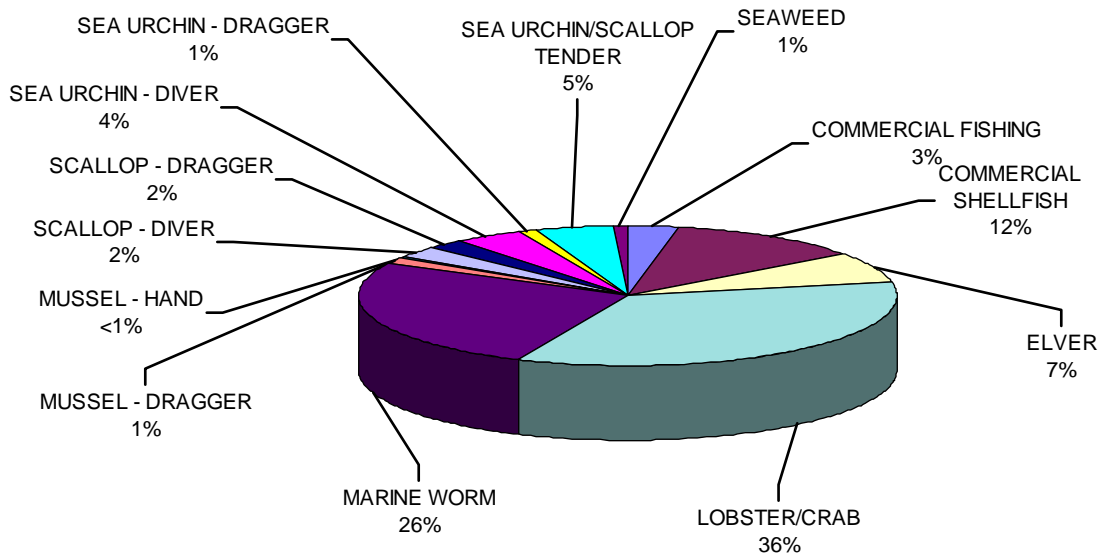
One objective of this project is to estimate the number of harvesters using the bay as a source of income. Using 2000 US Census data and the MDMR License Lists, one can estimate the number of regional households supported by local fisheries. Table 3 indicates that an average of 8.5% of the year-round households depend on marine resources as a source of income (11% in Sullivan, 9% in Hancock, and 6% in Franklin). It should be noted, however, that the licenses do not indicate where the harvester operates, so it is unknown how many households depend specifically on Taunton Bay fisheries.

Table 3. MDMR Harvest License (2004) and US Census Data (2000) for Hancock, Sullivan, and Franklin.

Town	Population (2000 Census)	# of Harvester Licenses	# of Harvesters	# of Year-round Households	% of Year-round Households with a Harvester
Hancock	2,147	118	90	983	9%
Sullivan	1,185	89	57	522	11%
Franklin	1,370	46	34	617	6%
Total	4,702	253	181	2122	8.5% (Average)

The license lists also indicate which species are harvested most in this region (Figure 1). Approximately one-third of all licenses issued in this region are for lobsters/crabs at 36%. The second largest category is marine worms at 26% and the third largest license category, at 12%, is shellfish, which although is issued for clams, quahogs, and wild oysters primarily represents clams in this area.

Figure 1. 2004 MDMR Licenses Issued to Hancock, Sullivan, and Franklin Harvesters by Species



Of all the species that are harvested in this region and represented by these data, only the marine worm, elver, shellfish, seaweed, sea urchin and scallop divers, mussel-hand and a very small percentage of the lobster/crab pertain to Taunton Bay. The remaining

fisheries are conducted outside of Taunton Bay: commercial fishing, scallop dragging, sea urchin dragging, mussel dragging, and most of the lobster/crab fishing.

According to personal interviews with dealers and harvesters, most license holders will fish waters that are closest to their homes in order to reduce costs and time/effort. If we assume that most Franklin-Hancock-Sullivan license holders fish Taunton Bay, then the licensing data can also be used to compare the number of harvesters living/fishing in the Taunton Bay region with those in all of Hancock County. In 2004 Franklin, Hancock, and Sullivan collectively represented 8.5 % of the total number of licenses issued in Hancock County (2966 county licenses). The top three fisheries in Hancock County are the same as for the region; only the percentages differ: in Hancock County 64% of all licenses are issued for lobster/crab, 7% are issued for shellfish and 6% for marine worms. The remaining Hancock County fisheries (elvers, scallops, urchins, mussels, etc) are all similar to the TB region and range from 1-5%.

Finally, the license data can be used to indicate changes over time. Between 1999 and 2004, the TB region represented 10-12% of the county licenses (Table 4). However, in 2004, there was a 20% decrease in the number of licenses issued in the TB region and at the same time, there was a 16% increase in the number of county licenses issued. The percentage of TB to county licenses dropped to 8.5 %. The reason for the slight decrease in TB licenses and the significant increase in county licenses is unknown.

Table 4. Comparison of Regional and County MDMR Licenses, 1999-2004.

Year	TB Regional Licenses	Hancock County Licenses	% of Hancock County
1999	315	2504	12.5%
2000	293	2611	11.2%
2001	260	2516	10.3%
2002	262	2511	10.4%
2003	273	2444	11.2%
2004	253	2966	8.5%

C. Personal Interviews as an Indicator of Harvesting Activity

The number of harvesters can also be determined through personal interviews. Table 5 is a list of the number of harvesters estimated through personal interviews (except clams and worms which are determined by licensing data). The total number of harvesters in TB is estimated to be 135, which is 77% of the 181 estimated from the MDMR license lists. Therefore, it is reasonable to assume that the number of harvesters in TB ranges from 135-181.

Table 5. Approximate Number of Harvesters/Enterprises as Estimated from Personal Interviews.

Species	Approximate # of Harvesters/ Enterprises in TB
Worms (Wild)	65 (License Data)
Elvers	20
Clam	32 (License Data)
Lobsters	3
Crab	3
Sea Urchin	3
Sea Scallop	3
Mussels	1
Alewives	1
Kelp	1
Oyster Aquaculture	1
Worm Aquaculture	1
Halibut Aquaculture	1
TOTAL	135

D. Value of Taunton Bay Fisheries

As stated in the introduction, one goal of this report is to determine the total value of the fisheries/resources of Taunton Bay. Using information gleaned from interviews with harvesters and marine specialists, as well as MDMR landings and licensing data, the total estimated revenue for all fisheries/resources obtained from TB during 2003-2004 ranges from \$4,170,258 to \$10,263,390. The significant range of revenue variability is most likely due to differences in effort, market, weather, and willingness to report accurate information (see Sections II A and II C).

The following is a brief description of each TB fishery and an estimate of its potential revenue to the individual harvester. The information was gleaned using one of three methods described above. Table 6 summarizes the individual potential revenue for each fishery/resource, as well as an estimate of the total value for each fishery in TB.

Table 6. Potential Annual Revenue Per Individual Harvester/Entrepreneur and Total Estimated Annual Revenue for Taunton Bay.

Fishery	Data Year	Potential Individual Annual Gross Revenue	Estimated # of Harvesters/Entrepreneurs	Total Estimated Annual Gross Revenue for TB	Data Source
Clam	2003	\$3,831	32	\$122,602	2
Worms (Wild)	2004	\$36,000-\$55,000	65	\$2,340,000-\$3,575,000	1
Mussels	2003	\$95,716	1	\$95,716	3
Kelp	2004	\$4,800-\$14,000	1	\$4,800-\$14,000	1
Sea Urchin	2004	\$18,900-\$141,750	3	\$56,700-\$425,250	1
Sea Scallop	2004	\$7,500-\$81,000	3	\$22,500-\$243,000	1
Lobsters	2004	\$45,000-\$55,000	3	\$135,000-\$165,000	1
Crab	2004	\$8,000 -\$10,000	3	\$24,000-\$30,000	1
Elvers	2005	\$45,000-\$270,000	18-20	\$810,000-\$5,670,000	1
Alewives	2005	\$12,000-\$15,000	1	\$12,000-\$15,000	1
Oyster Aquaculture	2003	\$106,760-\$125,600	1	\$106,760-\$125,600	1
Worm Aquaculture	2004	\$440,000	1	\$440,000	1
Halibut Aquaculture	N/A	N/A	1	N/A	1
Total Estimated Value of All Fisheries/Resources in TB				\$4,170,258 - \$10,263,390	

1 = Personal Interview

2 = MDMR Municipal-level Landings Data

3 = MDMR County-level Landings Data

I. Clams

(Source: MDMR Landings Data by Town)

I.1 Description

Soft-shelled clams have been commercially harvested from mud flats in Hog Bay, Egypt Bay, and Taunton River for the last century. With the exception of winter months, the season is generally year-round in clamflats that pass the state's sanitation requirements for clean water. Clam data are collected from wholesale dealers who report on a monthly basis. Dealers report the amount (pounds) and value of clams as well as the town and shellfish sanitation area of all clams they purchase to DMR. As such, there are more bay-level data on clams than any other species harvested.

Unfortunately, dealers only report monthly summaries, so it is unknown how many clambers the data represent. This number also does not represent any recreational landings made. Only the town of Sullivan has a clam ordinance and issues licenses to town residences and non-residences; Franklin and Hancock do not have clam ordinances.

I.2 Harvesters

According to 2003 licensing data, there are approximately 32 clam harvesters in the TB area.

I.3 Revenues

Figure 2 illustrates the amount of clams (pounds) landed in 1999-2003. Landings are highest in Sullivan in all years except 2003. In 2003, Franklin had the greatest amount of landings. Personal interviews suggest that these variations are due primarily to word-of-mouth communication between harvesters.

The dollar values (Figure 3) show a similar trend as the harvest data except for Franklin in 2003 when the value of those clams was greater than those from Sullivan. The reason for this anomaly is unknown.

MDMR landings data for 2003 indicate that the total revenue for clam landings for the three towns was \$122,602. Assuming that 32 harvesters operate in this region, this yields \$3,831/harvester/year.

Figure 2. Clam Landings (Pounds) Reported Harvested from Franklin, Hancock, and Sullivan, Maine (1999-2003)

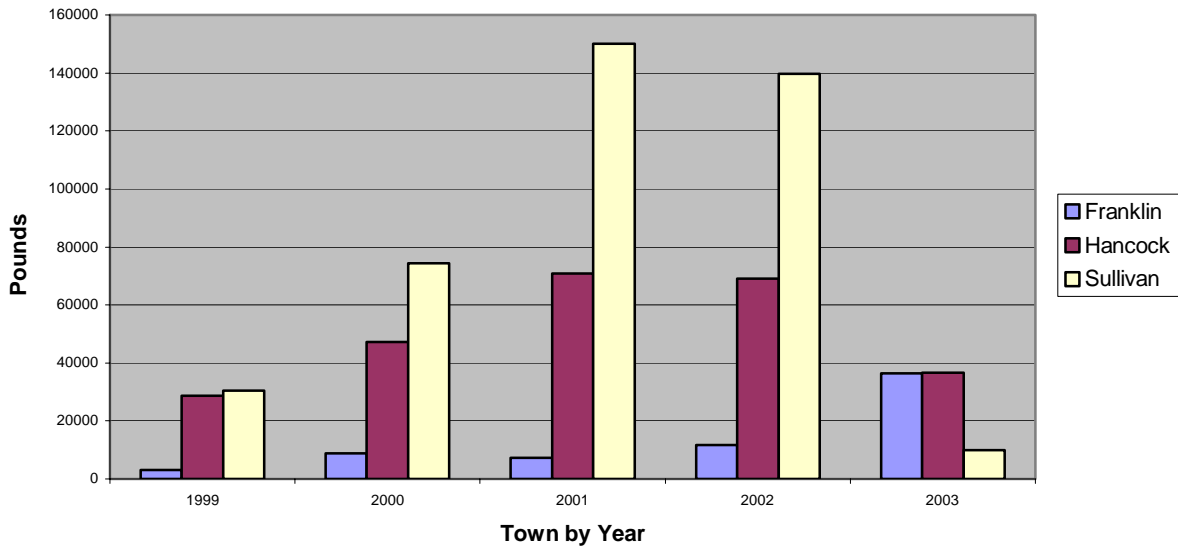
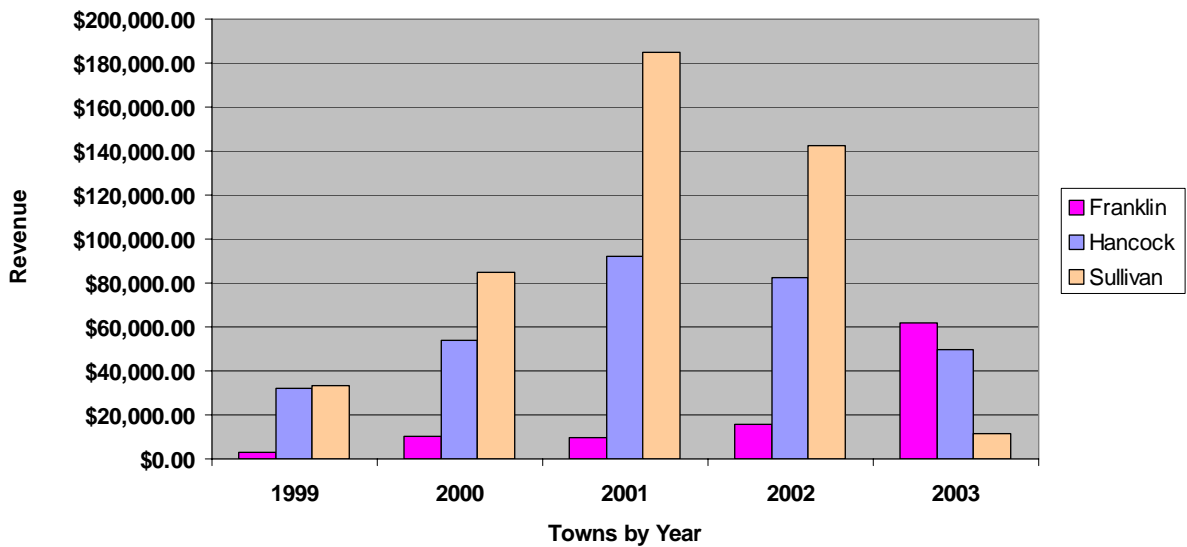


Figure 3. Clam Landing Revenues (Dollars) Reported to DMR for Sullivan, Hancock, and Franklin, Maine (1999-2003)



2. Worms (Wild)

(Source: Personal Interview)

2.1 Description

Bloodworms are harvested from TB mud sediment using a hoe and are sold to local dealers who sell/distribute them as bait for recreational marine fisheries (striped bass, rockfish, etc). Some areas along the coast are better habitat than others for worms; and full-time worm harvesters will travel to the more productive flats in order to maintain year-round harvesting. According to harvesters and dealers, on a scale of 1-10 (10 = best), TB is considered a 5-6, whereas, bays in Jonesport and Wiscasset are considered a 10.

Worms are harvested year-round, however, growth is best between late May and early September. Spring and winter worms are generally smaller due to cold mud temperatures whereas summer worms are generally larger. Furthermore, demand is highest in the summer.

2.2 Harvesters

According to 2003 licensing data, there are approximately 65 worm harvesters in the TB area.

2.3 Revenues

Most worm harvesters can harvest 500-600 worms from TB per tide. On those days when there are 2 daylight tides (every other week in summer), harvesters can harvest up to 1000-1200 worms in one day. The 2004 price was 30 cents/worm. At this price a dedicated harvest can make \$150-\$360/day. Using a 240-day year and adjusting for summer tides, an individual harvester can make \$36,000-\$55,000/year.

Given the above values, the total value of worms in this area can be estimated as:
 $65 \text{ wormers} \times \$36,000\text{-}\$55,000/\text{year} = \$2,340,000 - \$3,575,000/\text{year}.$

3. Mussels (Harvested)

(Source: MDMR Landings Data by County)

3.1 Description

Mussels grow on solid mud sediment, rocks, or structures and typically prefer the deeper sections of the bay and river channel where the water level is more constant. In 2000, TB was closed to dragging and continues to be closed. As a result, mussel harvesting in TB is conducted only by hand at this time. License data indicates that there is currently only one mussel hand-harvester operating in the bay. However, this harvester declined to offer information because of concerns that 1) confidentiality could not be maintained with only one harvester and 2) his/her harvest information might be used to shut the harvesting operation down. Therefore, little detailed information about the operation is available.

3.2 Harvesters

There is only one known mussel hand-harvester at this time in TB.

3.3 Revenues

Since there is neither bay-level data nor information from personal interviews, the estimate for mussels is derived from MDMR Hancock County data averages. In 2003, there were 25 mussel harvesters (both hand and drag harvesting) in Hancock County. The total revenue from Hancock County mussel landings was \$2,392,890. This is an average individual revenue of \$95,716/harvester/year.

4. Kelp

(Source: *Personal Interview*)

4.1 Description

Kelp is harvested by hand in TB by at least one harvester and is sold to an area processor who sells/distributes the kelp to natural food stores nationwide. It is high in major and trace minerals, proteins, and fiber and is used in soups, pastas, bean dishes, etc.

The harvester cuts the kelp frond at the stipe (stalk) using a sickle and leaves the stipe attached to the substrate. Kelp prefers solid substrates such as ledge or mussel beds. Every effort is made not to disturb the surrounding ecosystem and only 50% of the standing biomass is harvested per season, which allows the younger fronds to grow and be harvested in the future. The harvester dries the kelp after harvest, then delivers/sells the dry kelp to the processor.

Kelp is harvested in TB between April and late June when, although the fronds are not at their maximum length, they are at their maximum nutrient level. Although the bay has a healthy kelp population, the water is generally warmer than waters further Downeast. The colder waters off Jonesport and Addison have a longer harvest season (into September) and generally produce thicker fronds than those found in TB.

4.2 Harvesters

Because there is only one kelp processor in the area, that processor controls the number of kelp harvesters in TB. In an effort to reduce competition, there is only one known kelp harvester in TB at any given time.

4.3 Revenues

The processor estimates kelp biomass productivity in TB to be 12,000-20,000 pounds of wet kelp per year (leaving 50% biomass standing). Since kelp is 90% water, this translates into 1,200–2,000 pounds of dry kelp per year. Dry kelp is sold to distributors for \$4-7/dry pound depending on quality and market prices. Since it is believed that the bay can only sustain one harvester at this level per year, the annual income from kelp from TB therefore is \$4,800-\$14,000/year.

5. Sea Urchin

(Source: Personal Interview)

5.1 Description

Sea urchins are typically bottom dwellers and are therefore hand harvested by divers since there is no dragging permitted in this area. The urchins are sold to dealers who process them for their roe (egg mass) which is considered a delicacy in both the US and Asia.

The season is usually 45 days between October 1 and January 30 and is designed such that there are 3 days of harvesting followed by 4 days of no harvesting. In addition to MDMR restrictions, there are also weather and personal safety restrictions therefore; the average diver misses approximately 25% of the season.

5.2 Harvesters

According to personal interviews, there are 3 known sea urchin divers operating in TB.

5.3 Revenue

Area urchin harvesters report harvest rates of 900-1350 pounds/day or 31,500- 47,250 pounds/season (35 days). In recent years, prices have ranged from \$0.60-\$3.00/pound depending on quality of roe and supply. Therefore, individual annual income from urchins ranges from \$18,900-\$141,750/harvester/year.

Given the above values, the total value of urchins in this area can be estimated as:
 $3 \text{ harvesters} \times \$18,900\text{-}\$141,750/\text{year} = \$56,700\text{-}\$425,250/\text{year}.$

6. Scallops

(Source: Personal Interview)

6.1 Description

Scallops are similar to sea urchins in that they are typically bottom dwellers and are hand harvested by divers since there is no dragging permitted in this area. Scallops must be shucked, or shelled, at sea, and only meats are delivered to dealers.

The season is mid-December to mid-April and between weather, safety, and state management restrictions is approximately only 30 days during that 4-month period.

6.2 Harvesters

According to personal interviews, there are 3 known scallop divers operating in TB. It should be noted that the harvesters who dive for urchins are the same harvesters diving for scallops.

6.3 Revenue

Area scallop divers report harvests of 50-300 pounds meat/day or 1,500-9,000 pounds/season. In recent years, prices have ranged from \$5.00-\$9.00/pound meat. The individual annual income is therefore \$7,500-\$81,000/year.

Given the above values, the total value of scallops in this area can be estimated as:
3 harvesters x \$7,500-\$81,000/year = \$22,500-\$243,000/year.

7. Lobster and Crab

(Source: *Personal Interview*)

7.1 Description

Most area fishermen harvest lobsters and crabs in TB during the same season and using the same vessel although the types of traps may be different. Both species are bottom dwellers, and harvesters use wire mesh traps constructed of two compartments. Lobsters are generally sold to dealers (lobster pounds) or directly to retail establishments. Crabs may be sold to dealers, processors (for removal of meat), or directly to retail establishments.

Although the lobster and crab season is year round, the length of the average fisherman's season is dictated by boat type and effort of the individual fisherman. Many area fishermen only fish the summer months and restrict themselves to embayments rather than deeper waters.

7.2 Harvesters

According to personal interviews, there are three known lobster/crab harvesters in TB.

7.3 Revenue

Lobster: Harvesters report that in 2004, a 188-day season with 300 traps yielded \$45,000-55,000 annually. Given these values, the total revenue for the bay is:
3 harvesters x \$45,000-55,000/year = \$135,000-\$165,000/year.

Crab: Harvesters report that in 2004, a 188-day season with 100 traps yielded 20,000 pounds or \$8,000 annually. Given these values, the total revenue for the bay is:
3 harvesters x \$8,000 = \$24,000/year

8. Elvers

(Source: *Personal Interview*)

8.1 Description

Juvenile American eels are referred to as elvers and are harvested at the mouths of Egypt and Grist Mill streams and in Hog Bay. Adult eels spawn in the Sargasso Sea and the juveniles migrate to freshwater where they reach maturity. The elvers are harvested as they attempt to enter the freshwater streams.

Harvesters utilize fine-mesh fyke nets (a funnel shaped net) or dip nets to collect elvers as they ascend to fresh water. Elvers are sold to dealers who ship them to Asia (Japan, China, Taiwan, and Korea) where they are cultured and reared to adult size for the food fish market.

The fishing season for elvers is restricted to March 22-May 31. Harvest methods are restricted to hand dip and fyke nets with no more than two fyke nets allowed per license holder.

8.2 Harvesters

The total number of elver harvesters operating in TB is estimated to be 18-21: 10-12 in Hog Bay, 7 in Grist Mill and 1 in Egypt Stream. Since each harvester is permitted to have 2 nets, this represents 36-42 nets.

8.3 Revenue

Depending on the number of harvesters on the stream, the height of tide, and the weather (high rain reduces elver runs), harvest levels may range from 5-15 pounds/net/night. The average season is approximately 30 days, due to tide and weather; therefore the typical harvest per season is 150-450 pounds/net. 2005 prices ranged from \$150-\$300/pound so that the income from elvers is estimated to be \$22,500-\$135,000/net/year or \$45,000-\$270,000/harvester/year.

The total value of elvers in TB is estimated to be:

36-42 nets x \$22,500-\$135,000/net/year = \$810,000-\$5,670,000/year OR

18-21 harvesters x \$45,000-\$270,000/harvester/year = \$810,000-\$5,670,000/year

9. Alewives

(Source: Personal Interview)

9.1 Description

Like elvers, alewives spend part of their life at sea and part of their life in freshwater. However, unlike elvers, alewives spawn and reach maturity in freshwater then migrate to sea as adults. Adult alewives are harvested at the mouths of Grist Mill and Card Mill (Hog Bay) streams as they attempt to enter to spawn.

Unlike other fisheries in TB, the right to the alewife fishery is owned and managed at the town level. Most area towns place the local alewife harvest out to bid and give the contract to the highest bidder. The contractor pays the town (currently \$700-\$1000 per stream) and is permitted to keep most or all of the profits from the sale of alewives.

The fish are used primarily as bait, and the alewife harvesters sell directly to the lobster, halibut, and tuna fishermen without the use of a dealer. The season runs from May 1 to June 1 but there is a 72-hour weekly closed period when alewives may not be taken

(6:00 a.m. Thursday to 6:00 a.m. Sunday) in order to allow for adequate numbers to escape harvest, spawn, and produce future generations of fish.

9.2 Harvesters

Currently there is only one harvester operating in TB streams.

9.3 Revenue

Although the current harvest rate is 500 bushels/stream /season, local harvesters agree that the stream could support a harvest of 700-1000 bushels if managed properly. Moreover, if proper management continues the harvest rate could rise to 5,000-10,000 bushels/stream/season by 2008-2009.

2005 prices ranged from \$12-15/bushel which represents an annual yield of \$6,000-\$7,500/stream/year or \$12,000-\$15,000/harvester (2 streams)/year.

10. Oyster Aquaculture

(Source: Personal Interview and MDMR Communication)

10.1 Description

Oysters are grown in TB using seed stock from a hatchery in Waldoboro, Maine. The seed stocks are cultivated in screened trays for several months before planting in the substrate. Two tracts of submerged land in or near Hog Bay (Franklin) are used for the operation: Tract 1 for nursery cultivation (1.19 acres) and Tract 2 for planting (6.28 acres). Adult oysters are harvested after 2-3 years depending on productivity of site.

There is no limit on the number of oysters an operator can produce per site as long as the overall land used in operation does not exceed the permitted 7.47 acres. Harvested oysters are sold in shell to dealers or directly to retailers.

10.2 Harvesters

There is only one oyster aquaculture operation currently in TB. It should also be noted that there are no other marine-based aquaculture operations (e.g., blue mussel, salmon, etc) in the bay at this time.

10.3 Revenue

Information from the Maine Aquaculture Association and MDMR indicate that oyster aquaculture leases can potentially generate \$17,000-\$20,000/acre of harvestable oysters/year. Therefore, the TB lease could potentially generate \$106,760-\$125,600/year

11. Land-based Aquaculture

(Source: *Personal Interview*)

11.1 Description

The University of Maine Center for Cooperative Aquaculture Research (UMCCAR) is a land-based aquaculture research and development facility that is currently hosting worm and halibut aquaculture operations. The facility is located in Franklin and funded through UM, USDA, and NOAA. Their primary mission is to host companies interested in testing the feasibility of various aquaculture products, processes, and/or techniques.

The primary use of TB by the facility is as a non-consumptive water user. Water is withdrawn from TB via an intake pipe and is filtered, sterilized, degassed, and temperature-adjusted before it enters the system. After circulation, the water is filtered, treated, and released back into the bay.

The value of TB to the facility is a function of water quality. Although the water chemistry is considered good (low in pesticides, metals, or other toxins), the water quality is considered relatively poor for land-based aquaculture purposes. Because the facility is located in a shallow, muddy portion of the bay, the water contains large amounts of sediment and is often too warm in the summer and too cold in the winter for optimal growth. As a result, there are high costs associated with treatment of incoming water. If the facility were located in “deep water” (e.g., Schoodic Point), costs would be greatly reduced since the water temperature would be less variable and there would be less sediment to remove.

11.2 Harvesters

There is only one known worm/halibut aquaculture enterprise operating at this time at the UMCCAR.

11.3 Revenue

Although attempts have been made to place a dollar value on water used for aesthetic and recreational purposes, there does not appear to be any research suggesting a value for water used in aquaculture (or other forms of commercial processing). It is therefore, difficult to place a value on the water used in the UMCCAR facility. It is reasonable, however, to suggest that the naturally low quality of water at the head of the bay (high sediment, variable temperatures) is a liability to the aquaculture process that could be reduced at a better location.

Currently the facility is producing 11,000 pounds of worms per year at \$40/pound for a total annual revenue of \$440,000. Although this level of production is currently not profitable, a production level of 100 metric tons is anticipated and would be profitable.

There was no revenue information available for halibut production.

IV. RECOMMENDATIONS

1. **Conduct Comprehensive Economic Review.** The time and financial constraints of this project did not allow for a comprehensive economic study. As a result, the information presented here represents only a sampling of marine activities and economic analysis of the bay. This information should be used with caution as the issues are complex and require further consideration. Furthermore, state agencies and local organizations should pursue further funding to conduct a more comprehensive review of the local marine economy.
2. **Improve Availability of Bay-level Data.** If the concept of managing marine species and access issues within a given bay is to be successful, then more bay-level data/information (i.e., annual bay-level landings for each fishery) will be needed. This level of information is currently not available and therefore appropriate decisions cannot be made. The state should work directly with local communities and devise a method whereby bay-level or harvester-level data can be shared without threatening the confidentiality of harvesters.
3. **Engage Harvesters and Town Officials.** Harvesters and town government officials are the primary local users and decision makers of the bay. As the bay management initiative moves forward, both state and federal agencies and local conservation organizations should intensify efforts to engage harvesters and town officials. This can be achieved by forming a TB Harvesters Focus Group Session and possibly a TB Harvesters Committee whose charge it would be to provide input to the agencies and organizations.
4. **Document Harvesters' Management Concerns.** During the interview process, harvesters shared both economic and species management information and concerns regarding their individual fisheries. However, since the scope of this report was restricted to only economic information, a large amount of fisheries management information was NOT included. Therefore, there should be a well-planned effort to explore, document, and develop action items to address local fisheries management issues. This can be achieved through personal interviews, focus group sessions, and the formation of a TB Harvesters Committee.
5. **Develop Sustainable Yield Models.** Although the state collects landings data for various fisheries, there is little data on the potential biomass or yield for any given fishery, ecosystem, or specific bay. Future bay management decisions will require a greater understanding of the local ecosystem, the fishery potential and the effects of harvesting rates on that ecosystem and biomass potential. Therefore, MDMR and other researchers should develop local maximum sustainable yield and optimum sustainable yield models for the bay using ecosystem-based management principles.